THE OFFICE ACTION

Applicants have now had an opportunity to carefully consider the Examiner's comments set forth in the Office Action of October 8, 2003.

Claims 1-9 and 14-16 were rejected under 35 U.S.C. 103(a) as being unpatentable over Hay et al (4,238,828) in view of Naimark et al (4,857,902).

Claims 10-13 were allowed, which is gratefully acknowledged.

Reexamination and reconsideration are respectfully requested.

The Present Application

For purposes of brief review, the present application describes a method and apparatus for identifying a position of a preselected locating device in free space using a video image. The invention comprises a locating device which includes an alignment indicator representing a pointing direction and at least three equidistantly spaced co-linear points, all of which are limited in their placement to a position on the locating device. The locating device is observed by a video camera and known camera geometric dimensions provide a basis for converting the projected two-dimensional image of the locating device into a three-dimensional coordinate definition of the locating device in a free space.

The References of Record

Hay et al discloses a position detecting apparatus adapted to calculate the position of an object (e.g. the position of the operating head of a tunneling machine) from the detection in position of the projection of predetermined sets of points located on targets. The targets are attached to the object or attached to a member (e.g. the support member for the cutting head of a tunneling machine) which has a definable positional relationship to the object. The targets comprise radiation emitting devices (e.g. light emitting diodes (LEDs)) for emitting radiation to at least four defined points in a non-planar relationship such that a first set of three target points lies in a first target plane while a second set of three target points lies in a second target plane. The sets of target points are arranged as right angled triangles and are disposed at right angles to one another. A camera is arranged for viewing the targets, and being provided at the focal plane with a two-dimensional array of photo sensitive elements which can receive radiation from the radiation emitting means of the targets. A computer scans the array to generate signals indicative of the position of the images of the radiation emitting means on the array, whereby the position of the target and of the object to which it is attached is

determined. The scanning system requires multiple targets (i.e., cross target 9, ring target 10, and five lines of LEDs 20 to 24) for positive identification.

Naimark et al discloses a position-dependent interactivity system for image display. In particular, the invention provides an apparatus for interactive display of visual images that provides a feeling of real-time interaction by the user in traversing a library of preselected video frames. The system involves an interactive video display system which allows the user to access a library of contrived frames of video data stored in randomly accessible data locations such as an optical video disc. Each point in the data space is represented by a predetermined visual image to be displayed and visual images in the data space are related to one another by their positions in the data space. Through interactivity, the user learns to correlate the displacement of the input device with a change from one virtual position in the data space to another virtual position providing a tightly coupled apparatus for traversing the library of video frames.

Specifically as it relates to Naimark et al, a user provides input to the display system through a track ball or mouse which generates displacement signals. As the track ball or mouse moves, the position input signal provides X and Y coordinates of the changes in position of the track ball or mouse. The input signal is translated by a computer to an updated virtual position in the data space relative to a previous virtual position and the next frame having the updated virtual position is by a the video monitor. Other input devices that could be used in place of the track ball or mouse to generate position displacement signals are magnetic tracking devices mounted on a wand, mounted on a users' hand or otherwise mounted in a position giving the user control over the displacement of the device during update intervals.

Remarks

With respect to **claim 1**, the method was amended in Amendment A to identifying the orientation in free space of a preselected from a projected image of the locating device in a view plane of a video camera. As set forth in the October 3, 2003 Office Action, Hay does not disclose a system for identifying a position and pointing direction of a preselected locating device in a three dimensional free space.

Additionally, the applicant respectfully submits that the subject matter claims differs from the art taught in Hay et al in view of Naimark et al.

Hay teaches the detection of the position of an object from multiple targets having predetermined distance and direction relative to the object. In the preferred

embodiment, the targets are attached to the object, which are identified in multiple view planes of a video camera.

Naimark et al teaches position-dependent interactivity system for image display and provides an apparatus for such interactive display of visual images that provides a feeling of real-time interaction by the user in traversing a library of video frames. Said apparatus comprises a pre-programmed data space having certain nodes and segments, each node and segment location has a different visual image; a display system for displaying the defined visual images; an input device allowing the user to select the location on the data space; and translator to translate the X and Y coordinate position displacement of the input device to a virtual position in the data space.

In the present invention, the orientation in free space of a preselected locating device from a projected image of the locating device in a view plane of a video camera is claimed. The locating device is used to recognize and identify a particular point in free space by a user. The present invention discloses a method whereby the relative positions of indicia on the locating device itself are recognized, and the coordinate positions of the indicia are calculated based only on the relative positions and known camera geometric dimensions of the indicia.

The present invention is advantageous over Hay in that it does not require the target to be at a known distance from the object whose orientation is being identified. This creates a free range of motion for the locating device which is optimal for user interactivity with the three-dimensional free space where the locating device is oriented. Further, claim 1 differs from the system disclosed in Hay in that Hay teaches an apparatus whereby the location of LED lines on a target fixed to an object are detected in order to calculate the location of said object in lieu of the location of the target itself in three-dimensional free space.

Additionally, the Naimark input device (e.g. the track ball 53 of FIG. 5) is adapted to be displaced by a user in any direction in two dimensions only. As the input device is moved (the track ball), a position input signal provides X and Y coordinates of the changed position of the surface of the ball. This input signal is translated by the translator or computer to a virtual position in the data space which visual image is then displayed by a video monitor. The input device merely gives the user the ability to move in a given direction for an indefinite stretch so that long distances can be traversed in the data space. Accordingly, the intent of Naimark is

to provide visual images of predetermined data spaces (e.g. the Golden Gate Bridge) based on the X and Y coordinates of an input device (be it a track ball, mouse or a magnetic tracking device attached to a wand) and not to provide the location of an object (or for that matter the input device) in free space. As such, there was no motivation at the time of invention to combine the references of Hay and Naimark in that Naimark teaches away from Hay.

To further distinguish the subject matter claims from the cited references, the applicant respectfully directs the Examiner to the proposed amendments to claim 1 wherein the scope of such claim was narrowed to include a locating device comprising a plurality of recognizable indicia disposed thereon.

Accordingly, the applicant respectfully submits that it would not have been obvious to a person of ordinary skill in the relevant art employing a method for identifying location in free space of a preselected object through the use of attached targets as taught by Hay to incorporate the Naimark input device that is merely implemented to select certain points on a contrived data space to produce defined visual images to calculate the orientation of the claimed locating device in three-dimensional free space.

It is therefore respectfully submitted that claim 1 and claims 2-9 dependent on claim 1, distinguish patentably and unobviously over Hay et al and Naimark et al.

In addition to **claim 2** being distinguished because of its relationship to claim 1, claim 2 is again distinguished from Hay et al in view on Naimark et al. Hay describes a process whereby four (4) points on a target attached to an object are used to identify the object's position. Three (3) of the points are in a co-planar triangular arrangement (see Hay et. al, figures 2 and 4, indicated by the points A, B, C and D), and the four (4) points together are in a non co-planar relationship (see Hay et al, col. 6 line 10). In the present invention, the three points on the locating device are co-linear, creating an optimal arrangement for a locating device. Further, as it relates to Naimark and as aforesaid, the input device only provides a means under user control for generating position displacement information and not orientation of a locating device in three-dimensional free space through the projection of three preselected co-linear points on the locating device.

In addition to **claim 5** being distinguished because of its relationship to claim 1, claim 5 is again distinguished from Hay et al in view on Naimark et al. Naimark teaches an input device (again be it a track ball, mouse or a magnetic tracking

device attached to a wand) for communicating X and Y coordinates in a preset data space with defined visual images at certain nodes and segments in the data space which are displayed on a video projector. As such, the applicant respectfully submits that Naimark fails to teach a means for detecting three dimensional coordinate locations.

Regarding **claim 14**, the system was amended in Amendment A to include a locating device comprising a plurality of equidistantly-spaced, co-linear indicia disposed thereon. As set forth in the October 3, 2003 Office Action, Hay does not disclose a system for identifying a position and pointing direction of a preselected locating device in a three dimensional free space by mere recognition of indicia on the locating device alone.

Additionally, the applicant respectfully submits that there was no motivation at the time of invention to combine the references of Hay and Naimark. Hay discloses a position detecting apparatus primarily aimed at detecting the position of a predetermined object, in particular, the head of a tunneling machine by use of a video camera. Naimark discloses a position-dependent interactivity system for image display, which allows a user to interact with video data. The virtual position of video data is determined based on a contrived data space, so that when an operator uses a trackball or other device to select certain nodes or segments on the data space (such nodes and segments represent defined video data), the virtual position on a video monitor would change and an alternate video image would be displayed. Naimark simply utilizes an input device for identifying X and Y coordinates relative to a data space so that a virtual image can be displayed on a video monitor. As such, the applicant respectfully submits that it would not be obvious to combine a position detecting apparatus which detects the location of an object with a reference defining a system for video image interactivity and display.

It is therefore respectfully submitted that claim 14 and claims 15-16 dependent on claim 14 distinguish patentably and unobviously over Hay et al and Naimark et al.

CONCLUSION

For the reasons detailed above, it is respectfully submitted all claims remaining in the application (Claims 1-16) are now in condition for allowance. The foregoing comments do not require unnecessary additional search or examination.

No additional fee is believed to be required for this Amendment B. However, the undersigned attorney of record hereby authorizes the charging of any necessary fees, other than the issue fee, to Xerox Deposit Account No. 24-0037.

In the event the Examiner considers personal contact advantageous to the disposition of this case, he/she is hereby authorized to call the undersigned at Telephone Number (216) 861-5582.

Respectfully submitted,

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2/25/04
Date

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